forces concerned in the evolution of a "biologic form," viz., "specialising factors" and "generalising factors."

Attention is also drawn to the close parallel between (1) the behaviour of the fungus in the experiments in which the conidia were sown on the tissues of the leaf exposed by the cut; and (2) the biological facts obtaining in the class of parasitic fungi known as "wound parasites" (*Nectria*, *Peziza willkommii*, etc.), which are able to infect their hosts only through a wound.

"On the Origin of Parasitism in Fungi." By GEORGE MASSEE, Principal Assistant, Herbarium, Royal Gardens, Kew. Communicated by Sir WILLIAM T. THISELTON-DYER, K.C.M.G., C.I.E., F.R.S. Received January 11,—Read February 4, 1904.

(Abstract.)

Up to the present no definite explanation has been offered as to why a given parasitic fungus is often only capable of infecting one particular species of plant. This, however, is well known to be the case, for although the spores of fungus parasites germinate freely on the surface of any plant when moist, infection only takes place when the spores germinate on the particular species of plant on which the fungus is known to be parasitic. This apparently selective power on the part of the fungus I consider to be due to chemotaxis.

An extensive series of experiments were conducted with various species of fungi, including Saprophytes, facultative parasites, and obligate parasites, and the results are given in tabulated form in the full paper. The chemotactic properties of substances occurring normally in cell-sap were alone tested; among such may be enumerated saccharose, glucose, asparagin, malic acid, oxalic acid, and pectase. In those instances where the specific substance, or combination of substances, in the cell-sap assumed to be chemotactic could not be procured, the expressed juice of the plant was used.

These experiments proved that saprophytes and facultative parasites are positively chemotactic to saccharose, and this substance alone is sufficient in most instances to enable the germ-tubes of facultative parasites to penetrate the tissues of a plant, unless prevented by the presence of a more potent negatively chemotactic or repellent substance in the cell-sap.

As an illustration, *Botrytis cinerea*, which attacks a greater number of different plants than any other known parasite, cannot infect apples, although saccharose is present, on account of the presence of malic acid, which is negatively chemotactic to the germ-tubes of *Botrytis*.

In the case of obligate parasites the cell-sap of the host-plant proved to be the most marked positive chemotatic agent. Malic acid is the specific substance that attracts the germ-tubes of *Monilia fructigena* into the tissues of young apples; whereas the enzyme pectase performs the same function for the germ-tubes of *Cercospora cucumis*, an obligate parasite on the cucumber.

Immune specimens of plants belonging to species that are attacked by some obligate parasite owe their immunity to the absence of the substance chemotactic to the parasite.

Purely saprophytic fungi can be educated to become parasitic, by sowing the spores on living leaves that have been injected with a substance positively chemotactic to the germ-tubes of the fungus experimented with. By a similar method of procedure, a parasitic fungus can be induced to attack a different species of host-plant.

These experiments prove what has previously only been assumed, namely, that parasitism in fungi is an acquired habit.

A series of experiments prove that infection of plants by fungi occurs more especially during the night, or in dull, damp weather. This is due to the greater turgidity of the cells, and also to the presence of a larger amount of sugar and other chemotactic substances present in the cell-sap under those conditions.